United States Department of Agriculture

Visitor Capacity Analysis

Red Wild and Scenic River

Forest Service Cumberland Ranger District, Daniel Boone National Forest, Kentucky

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Contents

List of Tables

List of Figures

Introduction

The purpose of this report is to help determine the types and levels of visitor use that can occur within the Red Wild and Scenic River corridor while still protecting and enhancing the outstandingly remarkable values for which the river was designated. This report will inform the Red River Comprehensive River Management Planning process and environmental effects analysis of the plan and proposed activities in the Red River Gorge Management Planning Environmental Assessment (USDA 2021).

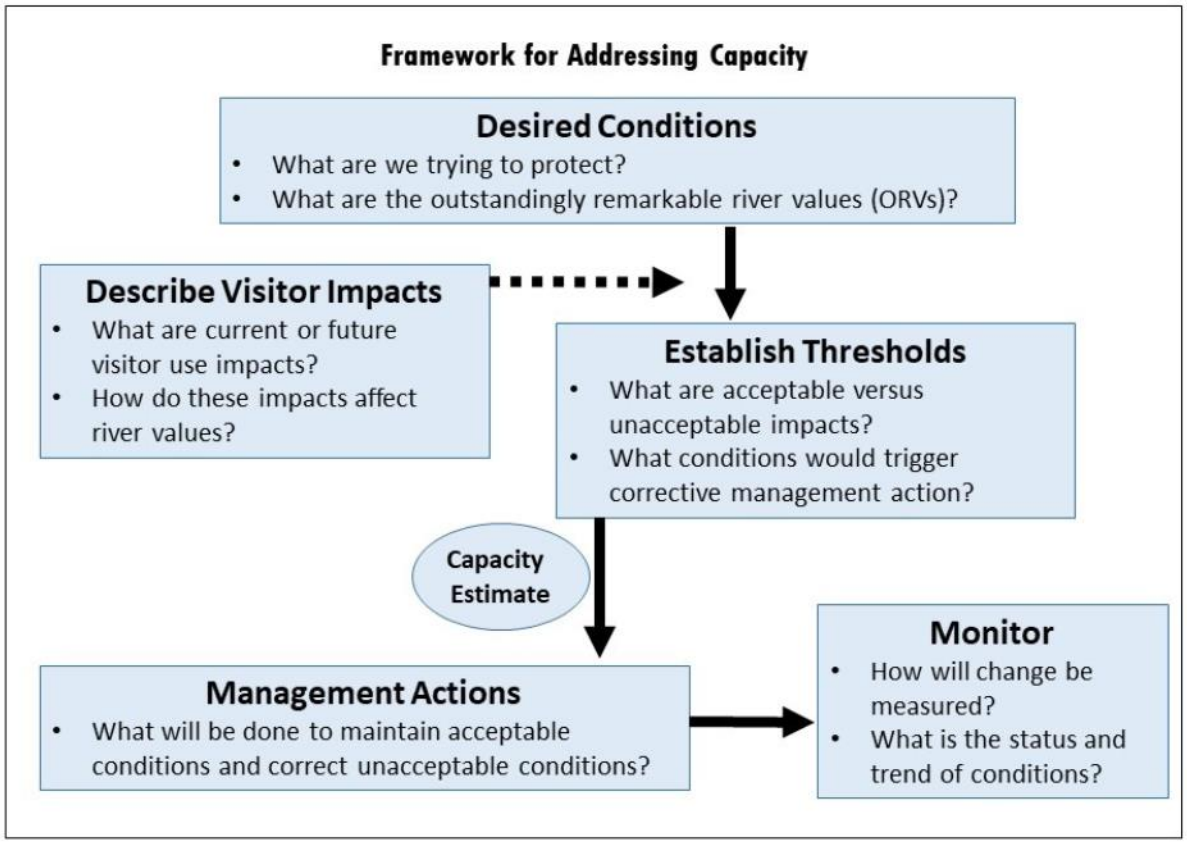
What is a Visitor Capacity Analysis?

The Wild and Scenic Rivers Act directs that river-administering agencies address visitor use capacities to protect the free-flowing conditions, water quality, and outstandingly remarkable values of designated rivers (Wild and Scenic Rivers Act, October 2, 1968). The 1982 National Wild and Scenic Rivers System: Final Revised Guidelines for Eligibility, Classification, and Management of River Areas defines carrying capacity as:

> The quantity of recreation use which an area can sustain without adverse impact on the outstandingly remarkable values and free-flowing character of the river area, the quality of recreation experience, and public health and safety. To further meet the requirement of the act, the guidelines note that: management plans will state the kinds and amounts of public use that the river can sustain without impact to the values for which it was designated.

Figure 1 shows how capacity estimates are derived from desired conditions for visitor experience and level of development, current impacts to river values, and determinations of management strategies depending on quantifiable thresholds.

Figure 1. Capacity Framework



The Interagency Wild and Scenic River Coordinating Council further described user capacities in their technical paper titled, "Steps to Address User Capacities for Wild and Scenic Rivers." This paper outlines the process for determining user capacity, specific to Wild and Scenic Rivers. We used this process to develop the capacity for the Red Wild and Scenic River (table 1).

Table 1. Steps to Address Capacity for Wild and Scenic Rivers

Step	Step Details
1	Describe the baseline and current conditions and uses for the Wild and Scenic River
2	Identify desired conditions for the river's values and classifications
3	Identify the kinds of use that the Wild and Scenic River corridor can accommodate
4	Identify measurable indicators for the desired conditions
5	Establish thresholds for each indicator
6	Identify triggers that elicit management response
7	Identify management actions to take when triggers are reached
8	Determine the Wild and Scenic River corridor's user capacity
9	Establish a monitoring and adaptive management approach

Step 1: Red River Current Conditions

The Red River Designation Act of 1993 (P.L. 95-625) amended the Wild and Scenic Rivers Act to designate 19.4 miles of the Red River as a wild and scenic river. Congress found that "the natural, scenic, and recreational qualities of the Red River in Kentucky are unique and irreplaceable resources; and the majority of the Red River corridor is within the Red River National Geologic area, which contains sedimentary rock formations unique to Kentucky and the United States, and should therefore be preserved for public enjoyment" (US Congress, 1993). The Act designated a 9.1 mile segment known as the "Upper Gorge," extending from the Highway 746 Bridge to Swift Camp Creek, as a wild river, and a 10.3 mile segment known as the "Lower Gorge," extending from Swift Camp Creek to the School House Branch, as a recreational river.

Overall, visitor use within the designated sections is high and, in some locations, threatens river values. While data collection has taken place over the years, some resources have not been studied extensively. As a result, the visitor capacity estimates included in this analysis recognize the likelihood that visitor capacity decisions may need to be reviewed and revised as more data becomes available. Additional management actions are proposed in this planning process and others may occur in the future, such as parking lot expansion or addition of canoe launches and takeouts. These developments can affect capacity, and, when completed, warrant a review of the estimated capacity in this document.

An interdisciplinary team has validated the outstandingly remarkable values (ORVs) for the Red River that are listed in the Daniel Boone National Forest Land and Resource Management Plan (forest plan) which include botany, geology, scenery, fisheries, recreation, and archaeology/history (USDA Forest Service 2004). As defined in the Act, water quality and free flow are values to be protected and enhanced for all designated rivers. Some negative impacts to river values are associated with user behavior rather than user capacity, such as damage from graffiti or site looting that impacts the archaeology/history river value. Where impacts are related to behavior rather than capacity, management actions related to these impacts will be addressed through education and law enforcement rather than capacity indicators and thresholds.

River Values Affected by Current Visitor Use

Botany: More people has increased trampling of vegetation, exposure of soil, and the introduction and spread of nonnative invasive plant species.

Geology: Visitor misbehaviors, including vandalism and graffiti on boulders in the river corridor, impact geological resources.

Scenery: Garbage, unauthorized campsites, and unauthorized trails in both the wild and recreational segments affect the scenic value. Visible evidence of bank erosion and denuding results from high levels of recreation use at favorite swimming holes and along the banks behind the Gladie Visitor Center along the recreational segment of the river. Erosion also occurs at unofficial boat launches and river access points. This reduces the scenic quality and setting for visitors.

Archaeology/History: Erosion, soil compaction, and digging are the most common types of disturbance users cause to archaeological sites. Unauthorized trails, areas deforested for campsites and firewood collecting, and clearings at the base of climbing routes all cause soil erosion and potentially damage archaeological remains. Finally, users frequently excavate small

pits in open areas and in rockshelters for latrines and fire hearths. This permanently alters buried archaeological deposits left by past Euro-American and Native American settlers.

Fisheries: Fish and other aquatic animals such as mussels can be affected by sediment load in the water from user-developed trails and campsites located close to the river.

Recreation: Erosion from unauthorized campsites, unauthorized trails, unofficial boat launch sites, river access points, and along clifflines below climbing routes; campfire and wildfire scars; litter, graffiti, and tree cutting; limited opportunities for solitude due to increased river users; and limited access including crowded or full parking areas all impact the recreation experience.

Water quality and free flow: Unauthorized trails, unauthorized campsites, unofficial boat launch sites, river access points, and other highly impacted areas are not maintained by the Forest Service and cause erosion and stream sedimentation. Improper human waste disposal or the amount of human waste can affect water quality. Free flow can be affected by river users dragging boats during times of low water.

Step 2: Desired Conditions

To define the desired conditions, the team reviewed several guiding documents and processes, described below:

Land and Resource Management Plan

Desired conditions described in the Daniel Boone National Forest Land and Resource Management Plan (forest plan) do not speak to capacity but do provide guidance on experiences (USDA Forest Service 2004, pp. 3-53 through 3-60).

Wild section:

- Hiking, primitive camping, rock climbing, fishing, hunting, canoeing, kayaking, and rafting are allowed where they do not adversely impact the wilderness resource (p. 3-53).
- Areas will be managed to meet or exceed Recreation Opportunity Spectrum experiences of Semi-primitive Non-motorized and Semi-primitive Motorized (p. 3-54).

Recreational section:

- Most types of outdoor recreation activities and wildlife enhancements occur where negative impacts to natural and cultural resources and forest visitors can be mitigated or controlled through regulation, facility design and operation, or other management (p. 3-58).
- Areas will be managed to meet or exceed Recreation Opportunity Spectrum experiences of Semi-primitive Non-motorized, Semi-primitive Motorized, Roaded Natural, and Rural (p. 3-60).

Recreation Opportunity Spectrum

The Forest Service uses the Recreation Opportunity Spectrum (ROS) to classify and describe a range of recreation opportunities available. The recreational settings are described on a continuum ranging from primitive to urban (ROS Book 1986, FSM 2310). A recreation opportunity spectrum setting is defined as the combination of physical, biological, social, and

managerial conditions that give value to a place. By combining variations in these conditions, it is possible to provide a diversity of recreational settings for visitors to enjoy.

The Forest Plan ROS classifications along the Wild and Scenic River corridor include Roaded Natural, small portions of Rural near developed areas outside of wilderness, and Semi-Primitive Non-Motorized. A Roaded Natural setting should have moderate evidence of human sights and sounds and moderate concentration of users at developed recreation sites. There are opportunities to socialize. A Semi-Primitive Non-Motorized setting should have a high probability of solitude, closeness to nature, and self-reliance. Typically, users experience 6 to 15 encounters with other parties on trails and 6 or fewer parties are visible from camping sites. In a Rural setting, high interaction among users is common. Other people are in constant view (FSM 2310).

Figure 2. ROS Classes along the Wild Segment

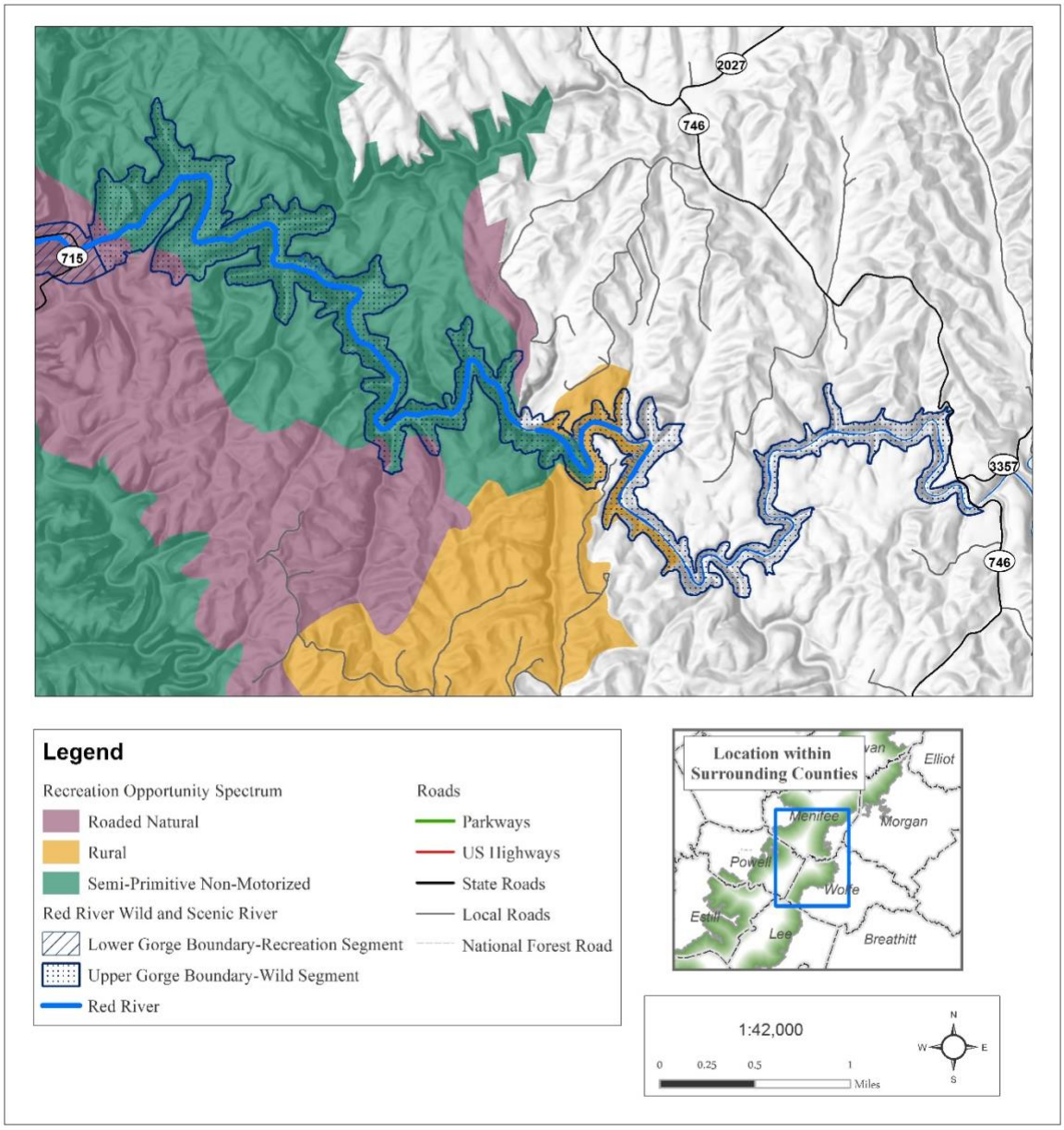
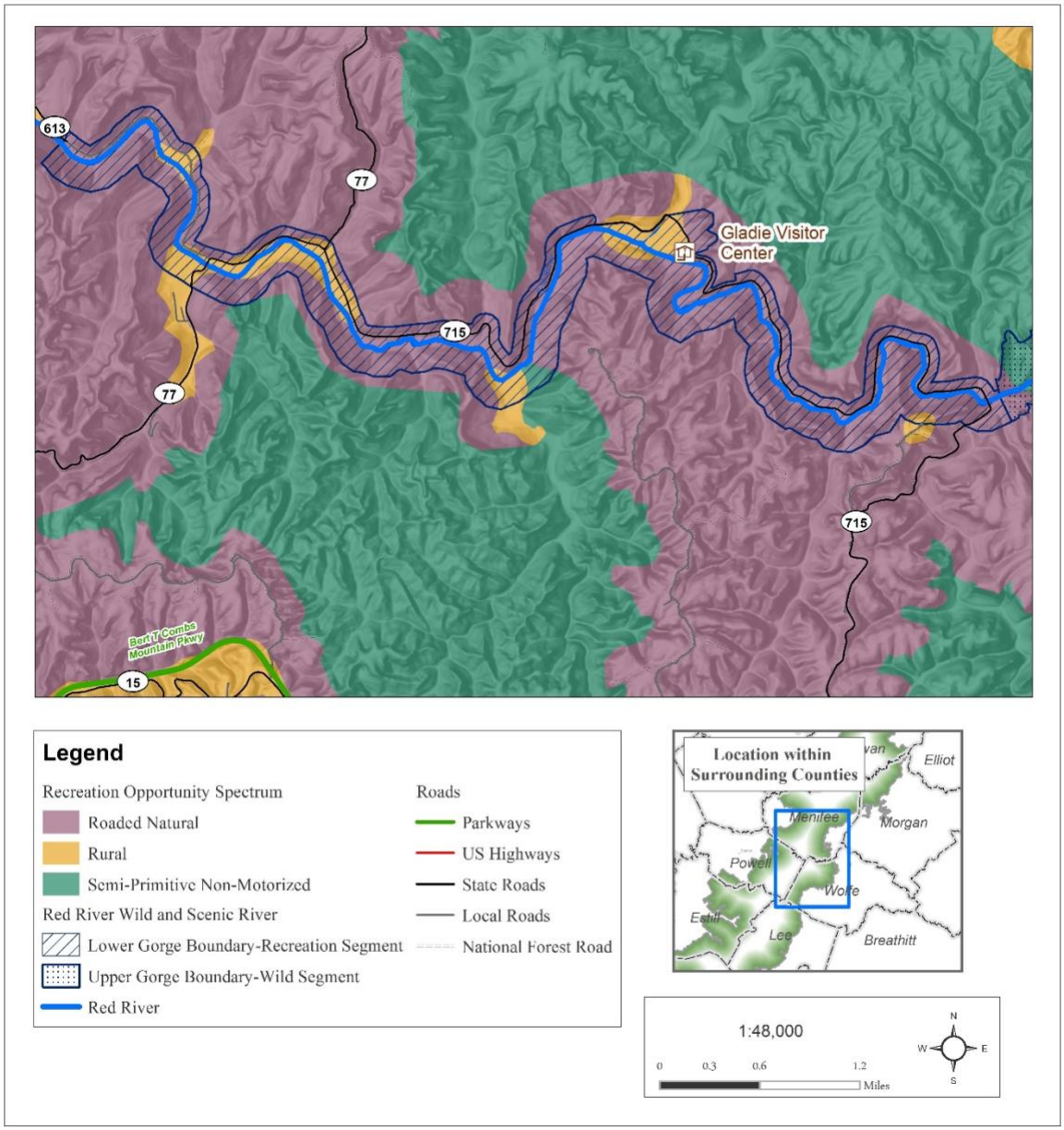


Figure 3. ROS Classes along the Recreational Segment



Limits of Acceptable Change

Considerable public involvement resulted in development of a Limits of Acceptable Change (LAC) analysis (USDA 2008) for the Red River Gorge. One step of the LAC resulted in a narrative description of resource, social, and managerial conditions defined as appropriate and acceptable for each opportunity zone. These zones were described on a continuum from Pristine to Concentrated Use. These LAC zones and their prescriptions were used to develop the capacity estimates in this document.

During the LAC analysis, the following desired social conditions were developed for each zone:

Pristine: High level of solitude and isolation.

Primitive: Moderate to high level of solitude and isolation. Groups are small, and there is a low probability of interaction with other humans.

Semi-Primitive: Some opportunity for solitude but evidence of, and interaction with, other visitors occurs.

Roaded Natural: There is little opportunity for solitude or isolation from the sights and sounds of human use. Moderate to high probability of contact with other people. Large groups may be encountered.

Concentrated Use: There is little opportunity for solitude or isolation from the sights and sounds of human use. The zone contains areas of concentrated use resulting in a high probability of contacts with other visitors.

Figure 4. LAC Zones along the Wild Segment

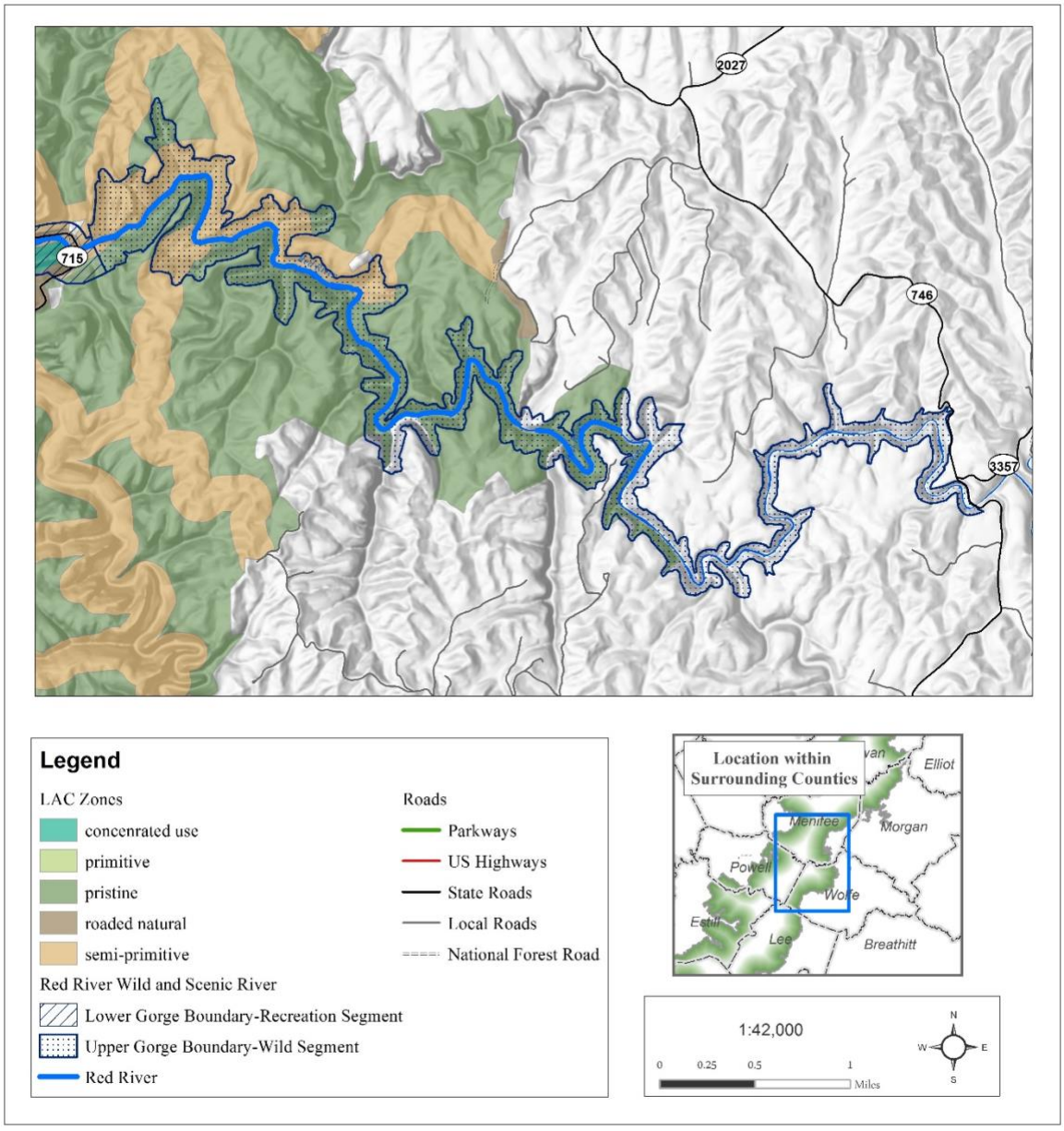
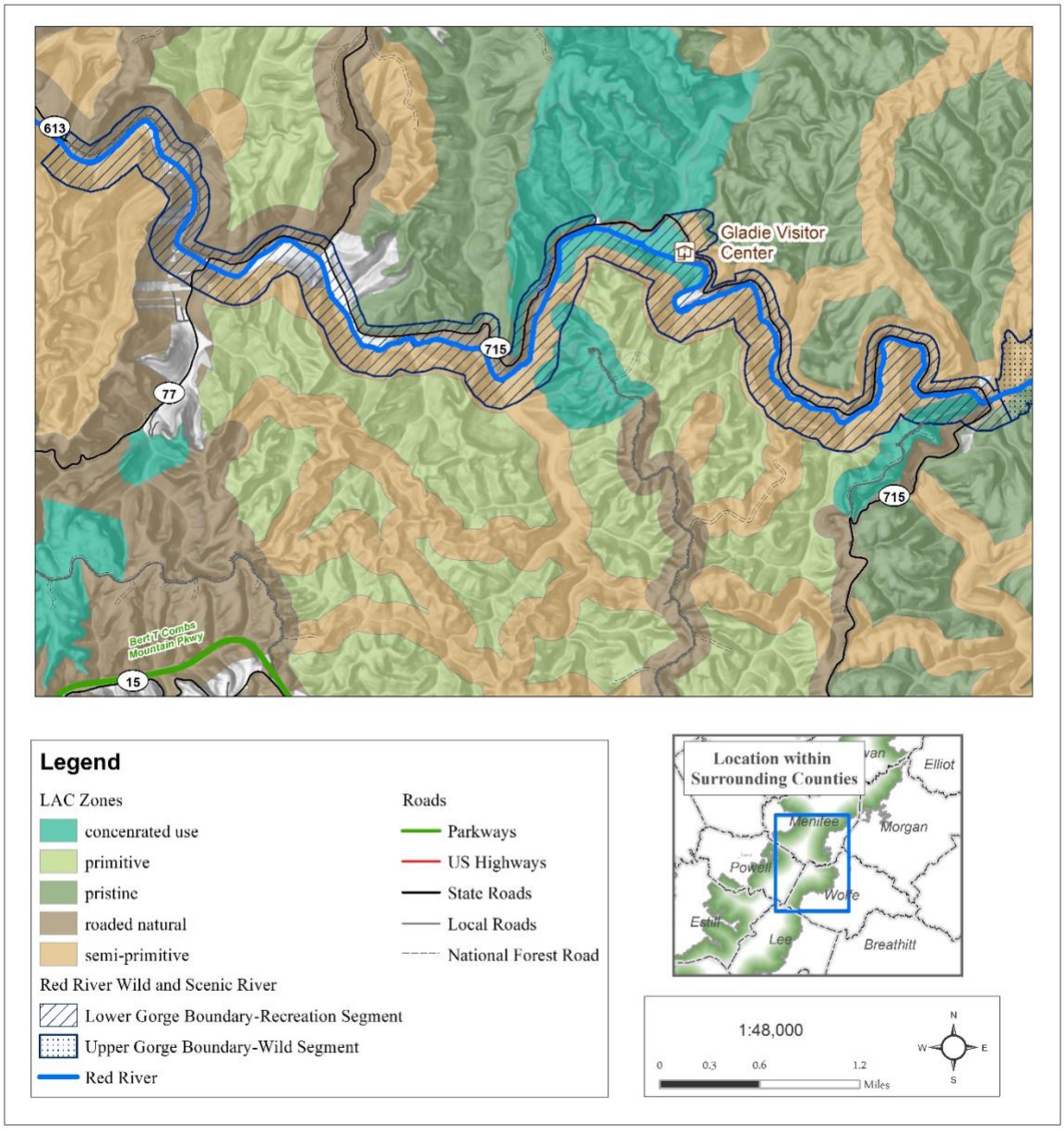


Figure 5. LAC Zones along the Recreational Segment



Current and Future Recreation Trends

Types of Use

Day use is the most popular type of river use. Most on-river use, including kayaks, and canoes, is completed within a day and occurs more often in the recreational section due to limited access and river difficulty in the wild segment. High levels of day use have impacted river values,

particularly along the recreational segment, where use is concentrated at destination points[1]. Impacts primarily related to amount of use, rather than behavior, include proliferation of unauthorized trails, erosion, vegetation loss, and crowding at popular destination points. Visitors frequently park illegally alongside roadways, causing congestion and vegetation loss inside and adjacent to the corridor, and contributing to safety concerns. The limiting attributes to day use capacity are **access and parking availability** at destination points, and **encounters with others** in other land-based areas of the corridor.

Overnight use is primarily from both backpackers on longer trail systems and dispersed campers hiking short distances from road systems. Erosion from continual use of trails and erosion of campsites, as well as campsite proliferation, have been problems in some areas. The limiting attribute to overnight capacity is **available campsites.** This refers to both physical capacity (campsites located in legal areas) and the social capacity (campsite density). A survey of all user-created campsites showed that over 75% were not in legal locations due to their being less than 100 feet from cliff bases, less than 300 feet from a system trail or road or located in rockshelters.

Outfitting use currently includes six outfitter-guides who are permitted in the river corridor, offering a variety of experiences including backpacking, river floating, and hiking. A total of 4,000 service days[2] were authorized in 2019, although not all days were used. The trend in service days from 2017-2019 is relatively stable, with no large increase or decreases seen. Most commercial services are for day use outfitting[3] (canoe rentals) and not guided use on the river.

Administrative use occurs occasionally in the river corridor. This includes forest personnel conducting field work, law enforcement patrols, and partner and volunteer groups engaged in restoration activities.

Uses originating from **private land** affect capacity in the river corridor. John Swift's Campground is located on private land and operated by a canoe outfitter (Red River Adventure). This business also shuttles people to the Forest Service Copperas canoe launch; the visitors then end at the private takeout owned by Red River Adventure. At another private inholding near Gladie, the owners are building cabins (Pumpkin Bottom).

National Visitor Use Monitoring

In response to the need for accurate recreation use data, the Forest Service has developed a permanent sampling system known as the National Visitor Use Monitoring (NVUM) program which has been implemented nationwide. It provides statistical recreation use information at the forest, regional, and national level. The most recent NVUM conducted on the Daniel Boone National Forest (2017) shows that half of forest visits last only eight hours, with a median of 6.8

[1] Destination points are defined as areas of interest that have disturbed vegetation, surface litter, or soils caused by human use. These areas include small arches, overlooks (vistas), rappel areas, waterfalls, and water access points.

[2] Service day is defined as an allocation of use constituting of a day or any part of a day on National Forest System lands for which an outfitter or guide provides services to a client. For example, an outfitter/guide could be given 25 service days for a location, or a location could be capped at 100 service days and that use divided between several outfitters/guides (FSH 2709.14 chapter 50).

[3] Outfitting refers to renting on or delivering to National Forest System lands for pecuniary remuneration or other gain any saddle or pack animal, vehicle, boat, camping gear, or similar supplies or equipment. The term "outfitter" includes the holder's employees and agents (FSH 2709.14 chapter 50).

hours, although this data is forest wide and not specific to the Red River. The average visitor group size was 2.6.

Visitor Surveys

Two detailed surveys have taken place in the Red River Gorge, in 2004 (Alexander, 2006) and 2013-2014 (Sharp, 2014). The sample in 2004 received 42% of the surveys from Sky Bridge and Chimney Top, while the 2013-2014 study gathered 42% of the sample from the Sheltowee Connector and the Gladie Visitor Center.

The 2004 study took place in June 2004 and a two-week period in October 2004. A total of 981 surveys were administered and completed. The 2014 effort surveyed 653 visitors. For this survey; data collection began in September 2013 and ended in September 2014. Vaske (2008) suggests that a sample size of 400 is considered a suitable number for generalizing to a population at the 95% confidence level with a ±5% margin of error for most parks, recreation, and human dimension studies. Though encompassing the entire gorge, these studies helped to derive conclusions for capacity for the river corridor.

The 2004 study reported an average of 5.3 people in each group. Regardless of the type of recreation in which they were engaged, visitors surveyed reported a tolerance for seeing five to seven people in addition to their own group. In turn, they reported feeling negatively or "unfavorable" about seeing more than five to seven people. Roughly 45% of visitors to the wilderness area estimated that they encountered 11 or more people during their visit. While they earlier reported negative feelings towards seeing more than five to seven people, even though they encountered more than this number during their visit, the majority reported that the number of other visitors they encountered was "just right." Most said they did not see serious concerns or problems with visitor use.

In the 2014 study, when asked about the perception of crowding, visitors reported feeling that the area they visited was "moderately crowded." About 50% of the 2014 survey respondents recorded that they saw between three and six other groups during their visit. When asked about seeing other visitors, people reported that seeing 30 others was slightly unfavorable, while feeling mostly neutral about seeing 9-10 people. However, most visitors surveyed said they did not approve of use limits and controls, even if they prefer to see fewer people. When comparing the two studies, researchers concluded that visitors were both encountering more people and more tolerant of increased encounters.

This survey information was used to develop the capacity estimates. In particular, the encounter and perception of crowding information was used in conjunction with the ROS class guidance for the semi-primitive dispersed use in the river corridor. The information was also used to develop an indicator and threshold related to visitor experience.

Step 3. Kinds of Use that can be Accommodated

Currently, a variety of recreational activities are pursued in the river corridor, including hiking, backpacking, camping, swimming, floating, fishing, rock climbing, and hunting. These uses can all be accommodated, though perhaps not all in the same locations. Uses that cannot be accommodated due to terrain or lack of use-specific designated trails include off-road vehicle driving, horseback riding, and mountain bike riding.

Steps 4-7. Indicators, Thresholds, and Management Actions

To monitor each river value, one or more key indicators were selected that will allow managers to be attuned to changes in the ecosystem or social setting. For each key indicator, a threshold was set. This value determined the amount of change desired or acceptable before river management objectives are no longer being met. In this manner, indicators and thresholds provide managers with information to determine if they are adequately protecting and enhancing river values and providing for recreational opportunities. In several cases, we identified indicators that are applicable to several river values. Thresholds were developed from several sources. These include thresholds developed during the LAC process, scientific judgment on impacts to river values, and state standards.

Indicator 1: Visitor satisfaction with number of encounters.
Relevant ORV: Recreation
Threshold: 80% of the time, 80% of visitors are satisfied or neutral with the number of encounters. Using the same questions as the 2004 and 2014 surveys[4], determine level of satisfaction (with number of encounters) and address dissatisfaction through the appropriate management action. Additional questions may be added as appropriate or needed.
Source: Limits of Acceptable Change Process
Potential Management Actions:

- Educate on timing and locations for visitors that are less crowded.
- Create or improve opportunities elsewhere.
- If other river values are impacted, implement a permit or quota system.

Indicator 2: Condition class of destination points.
Relevant ORVs: All
Threshold:

- Pristine and Primitive LAC zones: No destination point with a condition class greater than zero.[5]
- All other zones: No destination point with a condition class greater than 4.

Source: Limits of Acceptable Change Process
Potential Management Actions:

- Close and rehabilitate unsustainable river access points.
- Construct sustainable facilities, routes, and river access points if needed and where appropriate.

[4] Alexander, 2006; Sharpe, 2014.
[5] This condition class scale ranges from zero (no visible impacts) to 5, most impacted.

Class 0: Destination Point barely distinguishable; no or minimal disturbance of vegetation and /or organic litter. Often an old area that has not seen recent use.
Class 1: Destination Point barely distinguishable; slight loss of vegetation cover and /or minimal disturbance of organic litter.
Class 2: Destination Point obvious; vegetation cover lost and/or organic litter pulverized in primary use areas.
Class 3: Vegetation cover lost and/or organic litter pulverized on much of the site, some bare soil exposed in primary use areas.
Class 4: Nearly complete or total loss of vegetation cover and organic litter, bare soil widespread.
Class 5: Soil erosion obvious, as indicated by exposed tree roots and rocks and/or gullying.
Rock: Destination Point on bedrock.

Indicator 3: New bare areas on stream banks and floodplains within 100 feet of the riverbank in areas not planned as a managed area[6] of greater than 300 square feet that are attributable to visitor use.
Relevant ORVs: Scenery, Botany, Water Quality
Threshold: Any new bare ground area that exceeds 300 square feet.
Source: Forest soil scientist and hydrologist professional judgement
Potential Management Actions:

- Revegetate and restoration activities in bare areas over 300 square feet in areas not planned as a managed area.
- Restrict access through indirect methods (block entrances).
- Educational signage at appropriate points

Indicator 4: Disturbance of surfaces within rockshelters and overhangs from user activity (such as camping, walking, or climbing).
Relevant ORVs: Archaeology and History, Scenery, Botany, Geology
Threshold: Disturbance of soils or rock features within a rockshelter or overhang resulting from human use or activity. Disturbance includes but is not limited to compaction of soils from trails and camping, excavation or soil displacement of any kind, fire hearths and fire pits, and graffiti.
Source: US Fish and Wildlife Service and State Historic Preservation Office requirements
Potential Management Actions:

- First occurrence: The rockshelter or overhang will be subjected to a cultural resources survey to evaluate whether it is an archaeological site. If a site, it will be recorded and reported to SHPO. The report will follow SHPO standards and include a detailed plan view map of shelter surface and photographs showing compacted area to track change with future monitoring.
- Second occurrence: If an overhang has been documented as a site and monitoring reveals user activity continues to disturb it, install metal wire fence to block foot traffic.
- Third occurrence: If metal fencing cannot prevent continued use, the site will be evaluated for National Register of Historic Places eligibility (Phase II investigation). This triggers responsibility under Section 106 of the National Historic Preservation Act for additional protections and considerations.

Indicator 5: Human-caused disturbance of soils in open air locations (e.g., ridgetops, benches).
Relevant ORVs: Archaeology and History, Scenery
Threshold: 1 square meter of area in which soils have been disturbed to a depth that extends into the soil deposits below the forest duff or leaf litter or any disturbance that exposes artifacts. Examples include unauthorized trails, unauthorized campsites, user-created destination points, and eroded banks.
Source: State Historic Preservation Office requirements
Potential Management Actions:

- First occurrence: The location will be subjected to Phase I cultural resources survey to evaluate whether it is an archaeological site. If a site, it will be recorded and reported to SHPO. The report will follow SHPO standards and include a detailed plan view map of site surface and photographs showing disturbed area to track change with future monitoring.

[6] Managed areas include designated campsites.

- Second occurrence: If monitoring reveals user activity continues to disturb site, install a metal wire fence or other barrier to block foot traffic or use.
- Third occurrence: If metal fencing cannot prevent foot traffic or use, the site will be evaluated for National Register of Historic Places eligibility (Phase II investigation).

Indicator 6: Water quality rating (attributable to visitor capacity in the corridor).
Relevant ORVs: Water Quality, Fisheries
Trigger: Rating approaches fair[7]
Threshold: Below fair rating.
Source: Watershed plan (2015) and state water quality standards
Potential Management Actions:

- Reduce erosion from visitor use through closures, rehabilitation, and education.

Indicator 7: E coli values (attributable in part to visitor use).
Relevant ORVs: Water Quality, Fisheries
Threshold: No lower than state standard.
Source: Watershed plan (2015) and state water quality standards[8]
Potential Management Actions:

- Manage or reduce water contact recreation.
- Install signage and educate visitors.
- Pursue clean water grants for upper watershed.
- Complete a source assessment.

Step 8. Capacity Approach

Visitor capacity for the Red River focuses on locations where the amount of visitor use is most likely to first affect river values. This approach is more meaningful for effective visitor management rather than expressing capacity as a single number incorporating all possible uses within the river corridor. People at one time (PAOT) is used as an indicator of quality for sites whose experiential destinations are areas in which visitors linger (Manning 1996). Examples of such destinations are viewing platforms and beaches. In these locations, the number of other people sharing a space bears a strong relationship to feelings of crowding and freedom, important elements of experiential quality in parks and outdoor recreation (Manning et al. 1996). In addition, impacts to river values occur in these locations due to the amount of visitor use.

For the Red River corridor, we identified two separate capacities—day use and overnight use. For day use, we focused on destination points (listed in table 2), and land-based use outside of those destination points. For overnight use, we focused on campsite availability as defined by thresholds and desired conditions. Desired conditions from the forest plan, the LAC study, visitor preferences from the past surveys, current and expected impacts to ORVs, and ROS classes were used to inform the estimates.

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[7] Fair water quality scores indicate that water quality does not meet the standard or support the designated uses of cold water or warm water aquatic habitat based on macroinvertebrate sampling.
[8] (a) *Escherichia coli* content shall not exceed 130 colonies per 100 ml as a geometric mean based on not less than five (5) samples taken during a thirty (30) day period. Content also shall not exceed 240 colonies per 100 ml in twenty (20) percent or more of all samples taken during a thirty (30) day period for *Escherichia coli*. Fecal coliform criteria listed in subsection (2)(a) of this section shall apply during the remainder of the year.

Relationship of Capacity Range to River Values

If visitor capacity is kept to the ranges identified below, negative impacts to river values can be prevented. Larger amounts of PAOTs or total numbers of people per day can affect ORVs in many ways, including enlarging campsites and day use areas in order to find enough space to accommodate each group. Larger groups or total visitors per day contribute to overall volume of erosion, and unsafe and illegal parking, all of which impacts vegetation and archaeological sites located adjacent to roads, trails, campsites, and destination points.

Day Use Destination Point Capacity

For this capacity estimate, we used the factors listed above, as well as the limiting attribute of legal parking, both existing and proposed, to develop a range of people at one time. We also calculated an estimated capacity per day using typical parking lot vehicle turnover rates. A typical group size per party was also used. Table 2 below lists destination points by river segment and LAC zone, with current available and proposed legal parking and proposed shuttle stops.

Some considerations with the following estimates include that people per day capacity may be higher than the total actual number of people in the corridor per day because visitors often go to more than one destination point, boat launch, or trail per visit and may be counted as part of the PAOTs at multiple sites. The numbers below reflect the amount and type of use that can be accommodated in the river corridor without negatively affecting river values. As mentioned above, these numbers were derived from physical capacity (parking), LAC zone descriptions, ROS class guidance, NVUM group size, maximum size of shuttle buses, and visitor surveys.

Table 2. Day Use Destination Points

Destination Point	River Segment	LAC Zone	Available Parking (number of vehicles)	Proposed Parking (number of vehicles)	Proposed Shuttle Stop Locations
Big Branch canoe launch	Wild	Semi-Primitive	5	None	None
Eastern Osborne Bend Trailhead and Copperas Creek Canoe Launch (includes Eagle Point and Moonshiners Arch)	Recreational[9]	Semi-Primitive	37	15	1
1 proposed new boat launch with parking at 715/77	Recreational	Roaded Natural	None presently	20	1
Sky Bridge (Trailhead parking only)	Recreational	Concentrated Use	25	None	1
Dispersed Red River access points for river access	Recreational	Roaded Natural	61	40	4

[9] Located within the recreational segment but provides hiker access to the wild segment.

Destination Point	River Segment	LAC Zone	Available Parking (number of vehicles)	Proposed Parking (number of vehicles)	Proposed Shuttle Stop Locations
West Osbourne Bend Trailhead	Recreational	Semi-Primitive	6	None	None
Bell Falls	Recreational	Semi-Primitive	3	10	1
Gladie Visitor Center and Historic Site	Recreational	Concentrated Use	66	10	2
Sheltowee Trace trailhead and Suspension Bridge (includes Jump Rock)	Recreational	Semi-Primitive	17	5	1
Chimney Top Rock and Princess Arch	Recreational	Concentrated Use	15	25	1
FDR23 to Schoolhouse Branch (includes Edwards Branch and Long Wall)	Recreational	Roaded Natural	17	25	1

Measure: People at one time (PAOT) and people per day (PPD)

- *Group size:* We used average group size from the 2017 NVUM data (2.6) and for ease of calculations, rounded to 3 people per group. The assumption is that this group would be associated with one vehicle.
- *Legal Parking:* This measured the current and proposed legal parking availability associated with the destination point.
- *Shuttle stops*: Shuttles range from passenger type taxi services to buses with up to 15 passenger capacity. These are either on demand or on a set schedule. Expansion of shuttle services beyond the existing situation would increase capacity by reducing the number of personal vehicles that need parking while providing more opportunities for visitor access and freeing up legal parking spaces for other visitors in personal vehicles.

Destination point formula: We multiplied group size of three people by parking availability to determine people at one time. Then, we multiplied people at one time by vehicle turnover rate daily to estimate capacity of people per day.

$$3\ people\ x\ parking\ availability\ =\ People\ at\ one\ time\ (PAOT)$$
$$PAOT\ x\ vehicle\ turnover\ rate\ =\ People\ per\ day\ (PPD)$$

Shuttle Additional Capacity

The desired conditions include expansion of shuttle services. Currently, shuttles operate on demand and are limited in number of passengers and locations. Existing shuttle operators most commonly assist hikers in one-way trips, shuttling them back to their personal vehicle parked at a trailhead or boat launch along the river corridor, therefore facilitating recreation opportunities without increasing visitation numbers. Expansion of shuttle services can both provide for more one-way recreational opportunities such as hikes and boat trips and increase capacity by alleviating parking limitations. Limited legal parking spaces currently restrict capacity at destination points.

Park and ride shuttle opportunities from private or other parking areas outside the Red River corridor has the potential to increase visitation within the limitations of existing parking in the corridor. Because the amount and type of shuttles is unknown and would be authorized in response to demand, an estimate was developed to account for additional visitation from potential future park and ride shuttle operators. Future large-scale and/or long-term shuttle operators would require separate NEPA analysis and authorization under a special use permit. If the numbers in this estimate are exceeded, the forest would re-examine and revise the capacity analysis at that time, ensuring consistency with the comprehensive river management plan and the forest plan. Shuttles were estimated at the level and number of passengers below based on the typical bus size that would be permitted and the likely demand based on trends of use and proposed development on private lands. The estimates below are expressed as a maximum capacity and include the following assumptions:

- *Frequency:* Park and ride shuttles for areas including boat launches and trailheads would run less frequently than to destination points (sightseeing, swimming) since projected demand for park and ride is expected to accommodate tour opportunities to destination points, while hikers and boaters are more likely to use on-demand shuttles to facilitate rides back to their starting location on the river. We estimated three shuttles stopping daily at boat launches and trailheads. Park and ride shuttles for destination points would occur more often and regularly during the day, up to eight times daily.
- *Passengers*: We used a maximum of 15 passengers per shuttle for all calculations. However, shuttles could also consist of different configurations such as more trips by smaller rideshare or taxi vehicles; 15 people is the anticipated maximum due to maximum shuttle size. While actual number of trips may vary, the capacity is identified for total people per day.

Shuttle Formula: We multiplied a maximum of 15 shuttle passengers by trips per day to a given stop to estimate the maximum people per day arriving at a destination point via shuttles.

$$15\ passengers\ x\ trips\ per\ day = People\ per\ day$$

Table 3. Day Use Capacity at Destination Points

Destination Point	Total (existing and proposed) parking (number of vehicles)	People at One Time (PAOT) Calculation	Daily Turnover	Maximum People Per Day (PPD) from Parking	Shuttle Trips[10]	Maximum People Per Day (PPD) from Shuttles	Maximum Estimated Capacity Per Day (Parking plus Shuttle PPD)
Big Branch canoe launch	5	3 x 5 = **15 PAOT**	1 time	15 x 1 = **15 PPD**	N/A	N/A	15 PPD
Eastern Osborne Bend Trailhead and Copperas Creek Canoe Launch (includes Eagle Point	52	3 x 52 = **156 PAOT**	2 times	156 x 2 = **312 PPD**	3 trips	15 x 3 = **45 PPD**	357 PPD

[10] These are an estimate: more trips may be authorized with fewer people to reach a similar maximum capacity of total people per day.

Destination Point	**Total (existing and proposed) parking (number of vehicles)**	**People at One Time (PAOT) Calculation**	**Daily Turnover**	**Maximum People Per Day (PPD) from Parking**	**Shuttle Trips[10]**	**Maximum People Per Day (PPD) from Shuttles**	**Maximum Estimated Capacity Per Day (Parking plus Shuttle PPD)**
and Moonshiners Arch)							
Copperas Creek Canoe Launch Existing Shuttle					15 trips	15 x 15 =**225 PPD**[11]	225 PPD
1 proposed new boat launch with parking at 715/77	20	3 x 20 = **60 PAOT**	2 times	60 x 2 = **120 PPD**	3 trips	15 x 3 = **45 PPD**	165 PPD
Sky Bridge (Trailhead parking only)	25	3 x 25 = **75 PAOT**	4 times	4 x 75 = **300 PPD**	8 trips	15 x 8 = **120 PPD**	420 PPD
Dispersed Red River access points for river access	101	3 x 101 = **303 PAOT**	2 times	2 x 303 = **606 PPD**	8 trips each to 4 shuttle stops	15 x 8 x 4 = **480 PPD**	1,086 PPD
West Osbourne Bend Trailhead	6	3 x 6 = **18 PAOT**	2x	2 x 18 = **36 PPD**	N/A	N/A	36 PPD
Bell Falls	13	3 x 13 = **39 PAOT**	4x	4 x 39 = **156 PPD**	8 trips	15 x 8 = **120 PPD**	276 PPD
Gladie Visitor Center and Historic Site	76	3 x 76 = **228 PAOT**	2x	2 x 228 = **456 PPD**	8 trips each to 2 shuttle stops	15 x 8 x 2 = **240 PPD**	696 PPD
Sheltowee Trace trailhead and Suspension Bridge (includes Jump Rock)	22	3 x 22 = **66 PAOT**	2x	2 x 66 = **132 PPD**	8 trips	15 x 8 = **120 PPD**	252 PPD
Chimney Top Rock and Princess Arch	40	3 x 40 = **120 PAOT**	4x	4 x 120 = **480 PPD**	N/A	N/A	480 PPD
FDR23 to Schoolhouse Branch (includes Edwards	42	3 x 42 = **126 PAOT**	2x	2 x 126 = **252 PPD**	3 trips	15 x 3 = **45 PPD**	297 PPD

[11] Existing permitted shuttles typically have less than 15 passengers at a time. Estimates are based on total people shuttled to Copperas boat launch on high use days, which may include more shuttles with fewer passengers.

Destination Point	Total (existing and proposed) parking (number of vehicles)	People at One Time (PAOT) Calculation	Daily Turnover	Maximum People Per Day (PPD) from Parking	Shuttle Trips[10]	Maximum People Per Day (PPD) from Shuttles	Maximum Estimated Capacity Per Day (Parking plus Shuttle PPD)
Branch and Long Wall)							
Totals	**382**	**1,206 PAOT**		**2865 PPD**		**1440 PPD**	**4,305PPD**

Red River Corridor Day Use

Measure: People per day (PPD)

For this capacity estimate, we considered the desired conditions for the LAC zones, since these are more specific to different types of social experience than the ROS classes. The limiting attribute for these areas is the **social experience**—a lower level of encounters is expected outside of destination points. The main activity included in this category is day hiking on the Douglas Trail along the wild segment, and Sheltowee Trace trail along the recreational section, through Semi-Primitive, Roaded Natural, and Concentrated Use LAC zones. The maximum allowable group size in the Clifty Wilderness is 10 people; this helped inform our determination.

LAC did not adopt encounter rates for the zones; in the absence of this guidance, we referred to the ROS encounter guidance (see page 5) for Pristine (six or fewer encounters per day) and Semi-Primitive (six to 15 encounter per day). For encounter rates for other zones, we referred to the desired conditions and expected interaction with others as developed in the LAC process and determined a level of encounters that would correspond to each setting.

Wild Section:

The LAC zones for this section include Pristine and Semi-Primitive. To estimate capacity, we multiplied the number of encounters by zone by the maximum group size of 10 in wilderness, multiplied by normal day use turnover of twice daily to equal the total capacity per day outside of destination points:

Pristine:

$$6\ encounters\ x\ 10\ people\ x\ 2 = 120\ people\ per\ day$$

Semi-Primitive:

$$15\ encounters\ x\ 10\ people\ x\ 2 = 300\ people\ per\ day$$

Recreational section.

The LAC zones for this section are Concentrated Use, Semi-Primitive, and Roaded Natural. For these zones, we kept the 10 person group size, assuming that on average, groups engaged in dispersed activities along the corridor would not typically be higher than this, particularly due to the typical group sizes reported in the visitor survey and NVUM (5.3 and 2.6). As mentioned above, we applied a reasonable number of encounters based on the LAC desired conditions for each zone**.**

To estimate capacity in the recreational segment, we multiplied the number of encounters by zone by a maximum group size of 10, multiplied by normal use turnover in day use locations of twice daily to equal the total capacity per day outside of destination points:

Semi-Primitive:

$$15\ encounters\ x\ 10\ people\ x\ 2\ =\ 300\ people\ per\ day$$

Roaded Natural:

$$30\ encounters\ x\ 10\ people\ x\ 2\ =\ 600\ people\ per\ day$$

Concentrated Use: Most of this area is included in the Gladie destination point calculation. Where it is not, we used this formula:

$$45\ encounters\ x\ 10\ people\ x\ 2\ = 900\ people\ per\ day$$

Overnight Use

For this capacity estimate, we used the number of campsites that would allow for recreational opportunities while protecting ORVs. In addition, if monitoring shows that group sizes are consistently lower than the group size used for the calculation, the maximum capacity could be reduced.

Measure: People per night (PPN)

- *Group Size:* We used a maximum allowed visitor group size of 10 for all sites, based on forest plan direction for wilderness and to avoid enlarging campsites and affecting vegetation and water quality along the recreational segment.
- *Desired future designated campsites in each zone:* This number of sites was selected to preserve wilderness character, especially opportunities for solitude, and to protect and enhance ORVs. In addition, the overall physical capacity was considered; areas for campsites were not selected within the floodplain.

Overnight Use Formula: We multiplied the maximum group size of 10 by the number of campsites to estimate a capacity of people per night (PPN).

$$10\ people\ x\ number\ of\ campsites = People\ per\ night$$

Table 4. Overnight Capacity

Segment	Maximum Campsites	Campsites by LAC Zone	Calculations	Maximum Capacity (People per night)
Wild	15	15 Semi-Primitive	10 x 15 = 150	150 PPN
Recreational	20	5 Semi-Primitive; 10 Roaded Natural; 5 Concentrated Use	20 x 10 = 200	200 PPN (Includes: 50 PPN in Semi-Primitive; 100 PPN in Roaded Natural; and 50 PPN in Concentrated Use)
Totals Per Night in River Corridor				**350 PPN**

Step 9. Monitoring

Table 5 contains monitoring associated with indicators and thresholds. If thresholds are reached, potential management actions listed below would be implemented as appropriate.

Table 5. Monitoring Plan

Proposed Monitoring	Frequency	Comments
New unauthorized trails	Ad hoc during regular patrols by Forest Service staff	Map locations of any new unauthorized trails and rehabilitate or restore impacted areas where feasible.
Destination points: Condition class, parking lot utilization, parking turnover, illegal parking, and people at one time	Ad hoc during regular patrols by Forest Service staff	Track any changes to condition class at destination points. Examples include locations such as Eagles Peak, river access areas, Bell Falls, Jump Rock, etc. Track number of vehicles at each destination parking lot and number of people at each point. Track parking turnover per day on an ad hoc basis. If this does not align with the user capacity identified, consider enforcement, adaptive management actions, site design, or potential to consider needs for additional user capacity.
Visitor satisfaction	Every 5 years as funding is available or partners can support	Determine if 80% of visitors are satisfied 80% of the time. Develop specific questions about acceptable ranges of encounters and destination point space per person.
E coli levels	3-4 times weekly in high use season	Measure levels, identify probable cause, and implement adaptive management actions as needed.
Rockshelters & rock overhangs	Monitor sites in accordance agreements with USFWS and SHPO	Rockshelter and overhang settings often contain sensitive archaeological remains; a sample of these locales will be visited annually to track the effects of user activity.

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